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EXAMINER

MCNELIS, KATHLEEN A

ART UNIT PAPER NUMBER

1742

DATE MAILED: 07/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/718,961

Applicant(s)

BAMPTON, CLIFFORD C.

Examiner

Kathleen A. McNelis

Art Unit

1742

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7,9-15,17-20 and 24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7,9-15,17-20 and 24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Claims Status

Claims 1-7, 9-15, 17-20 and 24 remain for examination wherein claims 1, 9 and 20 are amended.

Acknowledgement of RCE

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(c), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.115, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/12/2006 has been entered.

Status of Previous Rejections

The previous rejection of claims 20, 21 and 24 under 35 U.S.C. 102(b) over Watwe is withdrawn in view of applicant's amendment of claim 20.

The previous rejection of claim 22 under 35 U.S.C. 103(a) over Watwe is withdrawn in view of applicant's amendment of claim 20.

The previous rejection of claims 1-24 under 35 U.S. C. 103(a) over Bampton et al. in view of Obara et al. and Freitag et al. is withdrawn in view of applicant's amendments of the claims.

DETAILED ACTION

Claim Rejections - 35 USC § 112

Claims 1-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites "...wherein the base metal and alloying metal are selected based on a charctersitic of the base metal to dissolve in but not react with the liquid alloying metal at an annealing temperature between the first and second melting temperatures...".

From this description, one of ordinary skill in the art would expect the base metal (i.e. titanium or titanium alloy) and alloying metal to have a binary phase diagram like those exemplified by Cu-Ti, Ti-V or Ni-Ti (Moffatts Handbook), wherein at temperatures between the melting temperatures of the two pure metals there are no intermetallic reactions. The Ti-Cu-Ni alloy recited in depending claim 6 is supported by this interpretation. However, depending claim 2 recites that elemental tin is the alloying metal, and since the phase diagram of Sn-Ti (Moffatts Handbook) shows that intermetallic reactions may occur at any temperature between the melting temperatures of the two pure elements, there is clearly another interpretation. For examination purposes, examiner has assumed that either type of phase diagram meets the limitation of claim 1.

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

Art Unit: 1742

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, 2, 9, 10, 20 and 24 are rejected under 35 U.S.C. 102(b) as anticipated by Abbott et al. (AeroMet implementing novel Ti process, 1998) or, in the alternative, under 35 U.S.C. 103(a) as obvious over Abbott et al. (AeroMet implementing novel Ti process, 1998)

With respect to claims 1, 9 and 24, Abbott et al. discloses a process for laser based direct metal deposition combining cladding and rapid prototyping technologies, similar to selective laser sintering, where metal powder is deposited onto a substrate and melted to build fully dense material (p. 24). Abbott et al. discloses depositing Ti-6Al-4V and Ti-5Al-2.5Sn alloys and teaches that precursor powder can be in either elemental or pre-alloyed form (p. 25). While Abbott et al. does not recited that the alloy is resolidified by withdrawing the energy beam thereby binding the alloy with the base metal, this would be the case since Abbott et al. discloses building upon completed layers on a substrate until a part is complete (p. 24). No carbon-based polymer is used in the process.

Alternatively, while Abbott et al. does not recite that no carbon-based polymer is used in the process, in the absence of evidence to the contrary one of ordinary skill in the art would expect this to be the case since carbides are not included in the final alloy composition and Abbott et al. does not disclose using a binder.

Abbott et al. does not recite that the base metal and alloying metal are selected based on a characteristic that the base metal dissolves but does not react with the liquid alloying metal at an annealing temperature between the first and second melting temperatures (instant claim 1) or that the alloying metal dissolves in the base metal forming a hyper-eutectic liquid composition (instant

Art Unit: 1742

claim 9), however, in the absence of evidence to the contrary, examiner contends that such would be the case with Ti-6Al-4V and Ti-5Al-2.5Sn alloys.

With respect to claims 2 and 10, Abbott et al. discloses the use of elemental powders to deposit alloys and discloses an alloy with tin as discussed above. With respect to claim 20, Abbott et al. discloses that the part is formed in accordance with a CAD file (p. 25).

Claims 1, 2, 9, 10, 20 and 24 are rejected under 35 U.S.C. 103(a) as obvious over Abbott et al. (AeroMet implementing novel Ti process, 1998) in view of Ryan (U.S. Pat. No. 4,725,509) or Blue et al. (1996) or Zhuang et al. (1997).

With respect to claims 1 and 9, Abbott et al. discloses a process for laser based direct metal deposition combining cladding and rapid prototyping technologies, similar to selective laser sintering, where metal powder is deposited onto a substrate and melted to build fully dense material (p. 24). Abbott et al. discloses depositing Ti-6Al-4V and Ti-5Al-2.5Sn alloys and teaches that precursor powder can be in either elemental or pre-alloyed form (p. 25).

While Abbott et al. does not recite that no carbon-based polymer is used in the process, in the absence of evidence to the contrary one of ordinary skill in the art would expect this to be the case since carbides are not included in the final alloy composition and Abbott et al. does not disclose using a binder.

Abbott et al. does not recite that the base metal and alloying metal are selected based on a characteristic that the base metal dissolves but does not react with the liquid alloying metal at an annealing temperature between the first and second melting temperatures.

Ryan discloses a filler metal useful for brazing and as a filler metal for titanium or titanium alloys (col. 2 lines 26-40). The alloy is disclosed as (24-30)-Ni, (15-21)-Cu balance Ti or Ti alloy (col. 7 lines 1-9) and is utilized as a powder (col. 3 lines 30-35). While Ryan does not recite that

the base metal and alloying metal are selected based on a characteristic that the base metal dissolves but does not react with the liquid alloying metal at an annealing temperature between the first and second melting temperatures (claim 1) or that the alloying metal is dissolved in the base metal forming a hyper-eutectic liquid composition (claim 9), such is the case for binary Ti-Cu and Ti-Ni. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the Ti-Ni-Cu alloy disclosed by Ryan in the laser based deposition process of Abbott et al. since the alloy disclosed by Ryan is particularly suited as a filler metal for titanium (abstract) which is desired in Abbott et al.

Alternatively, Blue et al. discloses the use of Ti-15Cu-15Ni as a filler material in a titanium matrix composite, teaching that the Ti-15Cu-15Ni allows for joining at lower temperatures and shorter times (p. 4041). While Blue et al. does not recite that the base metal and alloying metal are selected based on a characteristic that the base metal dissolves but does not react with the liquid alloying metal at an annealing temperature between the first and second melting temperatures (claim 1) or that the alloying metal is dissolved in the base metal forming a hyper-eutectic liquid composition (claim 9), such is the case for binary Ti-Cu and Ti-Ni. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the Ti-Ni-Cu alloy disclosed by Blue et al. in the laser based deposition process of Abbott et al. since Blue et al. teaches that the Ti-Ni-Cu can be deposited at lower temperature and results in joining in shorter times.

Alternatively, Zhuang et al. discloses a transient phase liquid bonding process wherein a melting point depressant is used (abstract). The melting point depressant is used as a coating on powder to promote transient liquid-phase bonding (p. 157-s). In the Introductory section, Zhuang et al. discusses previous studies in which interlayers of Ti-15Cu-15Ni powder was used to join Ti-

6Al-4V to eliminate residual pores (p. 158-s), which Zhaung et al. discloses can be made fully dense (p. 158-s). While Zhuang et al. does not recite that the base metal and alloying metal are selected based on a characteristic that the base metal dissolves but does not react with the liquid alloying metal at an annealing temperature between the first and second melting temperatures (claim 1) or that the alloying metal is dissolved in the base metal forming a hyper-eutectic liquid composition (claim 9), such is the case for transient liquid-phase bonding processes generally, and specifically for Ti-15Cu-15Ni. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Ti-15Cu-15Ni as a melting point depressant as disclosed by Zhuang et al. in the process of Abbott et al., since the use of melting point depressant reduces the time for isothermal solidification and result in fully dense parts as taught by Zhuang et al. (p. 157-s).

With respect to claims 2 and 10, Abbott et al. discloses the use of elemental powders to deposit alloys and discloses an alloy with tin as discussed above. With respect to claim 20, Abbott et al. discloses that the part is formed in accordance with a CAD file (p. 25).

With respect to claim 24, no carbon-based polymer is used in the process.

Alternatively, while Abbott et al. does not recite that no carbon-based polymer is used in the process, in the absence of evidence to the contrary one of ordinary skill in the art would expect this to be the case since carbides are not included in the final alloy composition and Abbott et al. does not disclose using a binder.

Claims 4, 5, 7, 12, 13 and 15 are rejected under 35 U.S.C. 103(a) as obvious over Abbott et al. (AeroMet implementing novel Ti process, 1998) in view of Blue et al. (1996) as applied to claims 1 and 9.

Abbott et al. in view of Blue et al. is applied as discussed above regarding claims 1 and 9.

Art Unit: 1742

Abbott et al. does not disclose that the powder is heated to a temperature of less than about 1700 °F (claims 4 and 12), about 449 °F (claims 5 and 13), or about 1700 °F (claims 7 and 15).

Blue et al. teaches that the temperature is a result effective variable which affects the time necessary for solidification and homogenization (pp. 4012-4013). It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the temperature as a result-effective variable to affect the solidification and homogenization time (see M.P.E.P 2144.05, II, B).

Claims 6 and 14 are rejected under 35 U.S.C. 103(a) as obvious over Abbott et al. (AeroMet implementing novel Ti process, 1998) in view of Blue et al. (1996) or Zhuang et al. (1997) as applied to claims 1 and 9.

Abbott et al. in view of Blue et al. or Zhuang et al. is applied as discussed above regarding claims 1 and 9.

Abbott et al. does not disclose an alloy of about 15% Ni, 15% Cu, balance Ti.

With respect to claims 6 and 14, Blue et al. or Zhuang et al. discloses an alloy of about 15Cu-15Ni-balance Ti as discussed above regarding claim 1.

Claim 17 is rejected under 35 U.S.C. 103(a) as obvious over Abbott et al. (AeroMet implementing novel Ti process, 1998) alone or in view of Ryan (U.S. Pat. No. 4,725,509) or Blue et al. (1996) or Zhuang et al. (1997) as applied to claim 9 and in further view of Marcus et al. (U.S. Pat. No. 5,182,170).

Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. is applied as discussed above regarding claim 9.

Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. does not disclose that each powder blend layer is between about 0.01 inch to 0.002 inch thickness.

Marcus et al. discloses a method for using selective laser sintering to build layers (abstract) wherein powder thickness of 0.005 inches for a given layer (col. 10 lines 6-27), which is within the disclosed range of between 0.01 and 0.002 inch (claim 17). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a thickness of 0.005 inches as taught by Marcus et al. in the process of Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al., since the processes are similar and produce similar products, since Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. is silent regarding powder thickness, and since Marcus et al. discloses that the invention can produce almost any three dimensional part (col. 3 lines 30-45).

Claim 18 is rejected under 35 U.S.C. 103(a) as obvious over Abbott et al. (AeroMet implementing novel Ti process, 1998) alone or in view of Ryan (U.S. Pat. No. 4,725,509) or Blue et al. (1996) or Zhuang et al. (1997) as applied to claim 9 and in further view of Das et al. (1999).

Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. is applied as discussed above regarding claim 9.

Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. does not disclose that HIP is performed following liquid phase sintering and isothermal solidification as in instant claim 18.

Das et al. discloses a method for producing titanium alloys by selective laser sintering followed by hot isostatic processing (abstract). Das et al. teaches that the combined method allows for freeform shaping capability and production of fully dense metal parts (p. 116). It would have been obvious to one of ordinary skill in the art at the time the invention was made incorporate the HIP process of Das et al. into the process of Abbott et al. alone or in view of Ryan

or Blue et al. or Zhuang et al. to produce fully dense parts as taught by Das et al. and as desired in Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al.

Claims 1 and 9 are rejected under 35 U.S.C. 102(b) as anticipated by in the alternative, under 35 U.S.C. 103(a) as obvious over Japanese Patent 06-272012 (JP '012).¹

JP '012 discloses a method of coating a Ti-6Al-4V alloy with a Ni-Ti powder by laser plasma hybrid spraying. While JP '012 does not recited that the alloy is resolidified by withdrawing the energy beam thereby binding the alloy with the base metal, this would be the case since JP '012 discloses that the purpose of combining the laser radiation with plasma spray is to improve alloying and adhesion at the interface (paragraph 0013). No carbon-based polymer is used in the process. No carbon-based polymer is used in the process.

Alternatively, while JP '012 does not recite that no carbon-based polymer is used in the process, in the absence of evidence to the contrary one of ordinary skill in the art would expect this to be the case since carbides are not included in the final alloy composition and JP '012 does not disclose using a binder.

While JP '012 does not recite that the base metal and alloying metal are selected based on a characteristic that the base metal dissolves but does not react with the liquid alloying metal at an annealing temperature between the first and second melting temperatures (claim 1) such is the case for Ti-Ni. While JP '012 does not recite that the alloying metal is dissolved in the base metal forming a hyper-eutectic liquid composition (claim 9), JP '012 discloses an example with a 65Ni-Ti alloy (paragraph 0026), which is a hypereutectic composition.

Claims 3 and 11 are rejected under 35 U.S.C. 103(a) as obvious over Abbott et al. (AeroMet implementing novel Ti process, 1998) alone or in view of Ryan (U.S. Pat. No.

Art Unit: 1742

4,725,509) or Blue et al. (1996) or Zhuang et al. (1997) or under 35 U.S.C. 103(a) as obvious over Japanese Patent 06-272012 (JP '012) as applied to claims 1 and 9 and in further view of Rongti (2001).

JP '012 alone or Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. is applied as discussed above regarding claims 1 and 9. Further, Abbott et al. discloses an exemplary alloy of 2.5 wt% tin as discussed above.

JP '012 alone or Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. do not disclose that the amount of tin is between 5 and 15 wt%.

Rongti et al discloses that tin addition to Ti can improve the wetting behaviour of Ti on substrates and discloses a composition of 10% tin (pp. 21 and 24). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a 10% tin composition as taught by Rongti et al. in the powder composition of JP '012 alone or Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. to improve wetting as taught by Rongti et al.

Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as obvious over Abbott et al. (AeroMet implementing novel Ti process, 1998) alone or in view of Ryan (U.S. Pat. No. 4,725,509) or Blue et al. (1996) or Zhuang et al. (1997) or under 35 U.S.C. 103(a) as obvious over Japanese Patent 06-272012 (JP '012) alone as applied to claim 9 and in further view of Huang (U.S. Pat. No. 6,042,780).

JP '012 alone or Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. is applied as discussed above regarding claim 9

JP '012 alone or Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. does not disclose that HIP is performed following liquid phase sintering and isothermal solidification as

¹ Based on Machine Translation into English

Art Unit: 1742

in instant claim 18, or that the pressure is about 1500 psi at temperature of 1800 °F as in instant claim 19.

Huang discloses a method for hot isostatic pressing (abstract) materials produced by selective laser sintering (col. 1 lines 49-53) or coatings (col. 8 lines 11-16), at a temperature not exceeding 1800 °C (col. 13 lines 23-26) at pressures as high as 1 GPa (col. 12 lines 25-31). Huang discloses processing Ti-6Al-4V powder in an inert (argon) atmosphere (col. 11 lines 52-59). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the HIP process of Huang to further density the SLS parts or coatings of JP '012 alone or Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. since the method of Huang excludes air and contaminants (abstract) and densification is desired in Abbott et al. alone or in view of Ryan or Blue et al. or Zhuang et al. The temperature range of not more than 1800 °C overlaps the claimed range of about 1800 °F. It would have been obvious to one of ordinary skill in the art to perform the HIP at a temperature of about 1800 °F, since Huang discloses that any temperature in the range not exceeding 1800 °C has utility for HIP. The range of 1 GPa overlaps the claimed range of about 1500 psi (about 10 MPa). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a pressure of 10 MPa, since Huang discloses equal utility for up to 1 GPa.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kathleen A. McNelis whose telephone number is 571- 272- 3554. The examiner can normally be reached on M-F 8:00 AM to 4:30 PM.

Art Unit: 1742

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


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